Atrial flutter: prenatal diagnosis and successful neonatal result

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Abstract

Objective: The objective of the study was to present a rare clinical case in neonatology, and emphasize the importance of teamwork that involves its clinical care. Effective communication and timely intervention increase patient success and survival rates. **Case:** Male patient at 37.4 weeks of gestation with a medical record of a mother with a positive rapid HIV test that during her follow-up appointment presented a persistent fetal heart rate above 220 beats/min, with a report of probable atrial fibrillation and restrictive ductus arteriosus. Programming an emergency cesarean section, a newborn was obtained who received electrical cardioversion, presenting a remission of symptoms. **Discussion:** A timely detection of prenatal atrial fibrillation was made thanks to the perinatologist, and following the recommendations of the literature, electrical cardioversion was performed. If it had not been detected in a timely manner, the patient could have died. **Conclusions:** It is significant to highlight that the detection of pathologies prenatally is becoming increasingly more important, since many of them require early and multidisciplinary management. It is fundamental, both for its diagnosis and for the success of the treatment, that the entire medical team is aware of the suspected diagnosis, as well as the immediate post-natal confirmation.

Key words: Fibrillation. Atrial. Prenatal. Arrhythmia. Neonatal.

Introduction

Tachyarrhythmias present an incidence of approximately 1 in every 3000 newborns, of which, 70% are supraventricular tachycardias and 30% are atrial flutters (AFs)¹. AFs constitute 1-2% of fetal arrhythmias broadly speaking and are generally of an idiopathic origin. Intervention on the fetus will depend on gestational age, hemodynamic repercussions, and linked cardiopathy². This article shows that a multidisciplinary team of well-coordinated specialists is able to detect pathologies prenatally and provides timely and successful treatment with proper communication. In addition, a revision of the literature will be conducted comparing the actions performed in this case.

AF is a supraventricular tachyarrhythmia characterized by rapid atrial activation, between 400 and 700 cycles/min. It is disorganized, with the consequent impairment of the atrial mechanical function, and characterized by an atrial/ventricular frequency ratio of 2:1 or greater, which causes heart failure, fetal hydrops, and death. There is a hypothesis that diastolic dysfunction, with left atrial enlargement, may predispose babies of diabetic mothers to atrial arrhythmias³.

In general, around 80% of patients are asymptomatic; however, 20% of cases present heart failure with tachypnea and difficulty swallowing, or data of cardiogenic shock⁴.

AF diagnosis by electrocardiogram is simple with sawtooth flutter waves, which are better seen in leads

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II, III, and aVF. In absence of structural cardiopathy, atrial fibrillation is observed almost exclusively in babies during their third trimester or at birth⁵.

Its detection forces us to rule out:

1. Ebstein's anomaly.
2. Transposition of great vessels.
3. Wolff-Parkinson-White syndrome.
4. Intra-atrial catheter stimulation.
5. Non-immune fetal hydrops.

It may present as an isolated AF (single episode, and isolated), or recurrent (two or more episodes of AF).

When ventricular frequency increases, some of the bundles in the branches may become blocked and produce an aberrated QRS complex, usually of the right branch.

One of the most severe complications is the formations of thrombi, mainly in the left appendage and its link to peripheral embolism, especially to the central nervous system⁶. When the atrial response is very quick, ventricular fibrillation and sudden death may occur. In fetuses with associated edema, linked with arrhythmia, mortality may increase from 15% to 40%, compared to 0% to 4% in fetuses without hydrops⁷.

Treatment

Electric cardioversion as first measure: 0.5-1 J/Kg (success in 87%).

Prenatal: pharmacologic digital cardioversion (0.25-0.5 mg orally, 3 times a day), flecainide (10-150 mg orally twice a day), sotalol (80 mg every 12 h), and in case of term pregnancies, the possibility of interruption of the pregnancy ought to be evaluated¹.

Other antiarrhythmics, including propranolol, amiodarone, procainamide, or verapamil, are also useful.

The most profitable method of cardioversion in a newborn with AF to date is electrical cardioversion, which also has the highest success rate⁸. Current energy recommendations for synchronized cardioversion of stable supraventricular tachycardia in children is 0.5-1 J/kg for the first attempt and 1-2 J/kg for subsequent attempts if the first is not successful. Some of the factors that may impact the success of electrical cardioversion treatment in adults are those which increase thoracic impedance, such as: pericardial effusion, the use of medications such as amiodarone and intubation at the moment of cardioversion. However, it has not been demonstrated that these factors have an impact on neonatal patients³.

Regarding prenatal management, digoxin is the treatment of choice with a success rate of 45.1%. It is also possible to use amiodarone and flecainide⁹. Recent

studies have shown the effectiveness of digoxin-based prenatal treatments as a first line of management with a success rate of 59%, increasing to 93% when linked to another antiarrhythmic such as sotalol (included in first line protocols) and flecainide as part of a second line of treatment but only in patients without associated hydrops. There are studies that recommend flecainide as a first line pharmaceutical for the treatment of fetuses with hydrops, yet the majority of the samples of these studies were patients with supraventricular tachycardia¹⁰⁻¹². This is possible since the bioavailability of flecainide is superior, since it passes through the placental barrier and reaches therapeutic levels in the blood of the umbilical cord even in hydrops fetalis, while digoxin in monotherapy is lower due to the alteration of placental transfer¹³.

Adverse maternal events linked to antiarrhythmics include gastrointestinal symptoms in addition to rhythm alterations which may effect of up to 78% of patients, being more frequent in cases that are managed with combined therapies. However, most of these adverse events are mild, and a reduction of the dosage allows the continuation of treatment.

We ought to consider the presence of fetal hydrops or the lack thereof for prenatal success, since we have seen that the level of digoxin in serum in hydroponic fetuses is between 20% and 50% of the levels of maternal serum, in contrast to the patients without hydrops, who present 80% and 100%¹⁰. Resolution of tachyarrhythmias managed prenatally can be delayed in non-hydrops fetuses, from a 3-day median, and with the presence of edema, up to 12.5 days, considering that a second pharmaceutical may be necessary for the resolution of the clinical picture¹⁴.

Concerning recurrences, they may reappear in the following 2 weeks, even if it is well-controlled when managed prenatally⁸. Maintenance of treatment postnatally will not be necessary when the flutter reverts to sinus rhythm spontaneously or easily responds to electrical conversion. Recurrences generally occur in the first 24 h of the initial episode, in patients with associated arrhythmias and those who have linked structural anomalies. These patients usually receive beta-blockers or digoxin and beta-blockers over 6-12 months, even though recurrences are usually rare^{4,15}.

Clinical case presentation

The patient, a 25-year-old female, first pregnancy, was found to be HIV+ during pregnancy, treated with tenofovir, emtricitabine, and raltegravir, with an undetectable viral load and CD4 < 500. An ultrasound was reported by fetal

medicine: single fetus, alive, cephalic, with fetal tachycardia, biparietal diameter 90.1 mm, 36.3 weeks of gestation (WOG), cephalic circumference 327.5 mm, 37.1 WOG, abdominal circumference 336.9 mm, 37.4 WOG, femoral longitude 67.9 mm, 34.6 WOG, humeral longitude 59 mm, 34.1 WOG, average fetometry 36 WOG, estimated fetal weight of 3029 g (89.6 percentile), amniotic fluid index 3 cm (oligohydramnios), fetal tachycardia > 200 beats/min (bpm) (FCF 238-587 bpm), atrial rate (474 bpm)/ventricular frequency (238 bpm)/2:1, abnormal myocardial contractibility, non-pulsatile umbilical vein, wave A ductus venous, AF diagnosed, and restrictive ductus arteriosus.

Given these findings, pregnancy interruption through abdominal c-section was decided on, obtaining a masculine fetus, 37.4 WOG/Capurro, weight 3080 gr, Apgar 879, heart rate (HR) 230 bpm, and palpable peripheral pulses. He is taken to the neonatal intensive care unit for monitoring, omphaloceles, and a solution plan, with a HR of 230 bpm, mean arterial tension of 50 mmHg, SaO₂ 99%, and a respiratory frequency of 42, thoracoabdominal X-ray normal (Fig. 1). An electrocardiogram confirms AF, and an echocardiogram conducted by a pediatric cardiologist reported a structurally normal heart, corroborating the AF diagnosis (Fig. 2). We intubated preceding sedoanalgesia with fentanyl (0.5 mcg/kg/do single dose) and midazolam (100 mcg/kg/dose), and an electrical cardioversion was performed at 1.5 joules obtaining immediate sinus rhythm (Fig. 3). We continued with amiodarone (7 mcg/kg/min in infusion) for 48 h and later with propranolol at 0.5 mg/kg every 8 h.

With a favorable evolution, extubation was accomplished at 48 h. We monitored for 72 h more, continuing with sinus rhythm and feeding adequately egressing with propranolol, zidovudine, and lamivudine and with follow-up appointments at neonatology, cardiology and infectiology.

Discussion

The present case is an infrequent case in neonatology, one which stood out because of its timely intervention by the perinatology, neonatology, and cardiology teams.

In this case, a well-timed detection of a prenatal atrial fibrillation was performed thanks to a control obstetric ultrasound. With the early diagnosis, we opted for the interruption of pregnancy through an emergency C-section since the patient was at term and, as previously mentioned, success rates were higher in post-natal management with electrical cardioversion than with pharmacological prenatal management, notifying the medical team of neonatology and pediatric cardiology.

Figure 1. Admission X-ray: plain anteroposterior thoracoabdominal X-ray showing both lung fields with normal appearances, with a well-defined cardiac silhouette, and other findings, both arterial and venous omphaloskepsis catheters, shown in adequate positions.

Figure 2. Electrocardiogram performed before electrical cardioversion showing the characteristic "sawtooth" pattern corresponding to atrial fibrillation; the heart rate is > 240 beats/min.

Figure 3. Electrocardiogram after electrical cardioversion: this electrocardiogram shows a sinus rhythm with an estimated heart rate of 140 beats per minute, the complex "qrs is normal."

Taking into consideration the fact that the patient could have suffered rhythm changes during his birth transition and for medical-legal purposes, post-natal diagnostic confirmation was necessary by the previously mentioned team of physicians.

The management, once confirmed, consisted of electrical cardioversion as described in the bibliography, keeping in mind the possible complications and anticipating the possibility of cardiac rhythm change to

ventricular fibrillation, supraventricular tachycardia, and cardiac arrest was justified by prior authorization from the father to sedate and intubate the patient, securing airways, and monitoring vital signs before treatment, which resulted a success without presenting failure nor recurrence of the AF.

Hospital stay was extended discretely since the withdrawal of sedation was gradual, subsequently beginning the period of highest risk of recurrence, leading to monitoring, and full echocardiographic assessment to rule out structural anomalies.

Without the timely detection of atrial fibrillation, perhaps the patient would have had passed away prenatally without even a certain diagnosis. As mentioned before, the risk of recurrence is low, and even though some articles mention that prophylactic management may not be necessary, we decided to leave management with antiarrhythmics during hospital monitoring and subsequently with propranolol, with successive appointments with cardiology to consider whether or not management would continue for 6 or 12 months as mentioned in the bibliography.

Conclusions

Prenatal care by the perinatologist alongside the neonatologist has become increasingly important, since timely perinatal diagnosis of different pathologies can provide time to perform ample guidance and family support. Similarly, it has been proven that neonatal mortality is affected when there is a possibility to plan a better therapeutic option and with enough time to put together a multidisciplinary team necessary for proper care.

In the same way, it is essential to stress the importance of continuous monitoring during pregnancy and prenatal control by the perinatologist, since they are the most adequate physician for this task, taking into account the fact that he/she has the best training for the detection of pathologies, and structural as well as fetal heart rhythm, just as in the presented case.

The success of the present case was thanks to timely detection and proper treatment by a multidisciplinary team. It is important not to forget the follow-up after the patient discharge.

Conflicts of interest

The authors declare that they not have any conflicts of interest.

Financing

The authors declare that this project did not require any financing.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the code of ethics of the world medical association (Declaration of Helsinki).

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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